

## REMARKS

Claims 1, 2, and 4 to 32, as amended, appear in this application for the Examiner's review and consideration. Claims 4 to 12 and 19 to 24 have been withdrawn from consideration as not being directed to the elected species. The amendments are fully supported by the specification and the claims as originally filed. Therefore, there is no issue of new matter.

The present Final Office Action states that the Declaration of Christopher P. Ludwig under 37 C.F.R. §1.132 ("the Rule 132 Declaration") is unpersuasive for the reasons set forth on page 2 of the present Final Office Action. In response, Applicants submit that, where required, the claims have been amended to change the terms "comprising" and "comprises" to --consisting essentially of-- and --consists essentially of--, respectively, clearly defining the scope of the invention. Moreover, the claims, as amended, do not recite "an intimate mixture," and have been amended to better define the mix intimacy discussed in the Rule 132 Declaration. Therefore, Applicants respectfully request reconsideration of the Rule 132 Declaration.

Claims 1, 13 to 18, and 25 to 32 were rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for the reasons set forth on pages 2 to 6 of the present Final Office Action, and under 35 U.S.C. §112, first paragraph, as allegedly containing subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed for the reasons set forth on pages 6 and 7 of the present Final Office Action.

In response, Applicants submit that one of ordinary skill in the art would understand that the recitation of "comprising" with regard to the oxidizer composition in original claim 1 was limited by the recitation of "consisting essentially of" as the transition for that claim. However, to facilitate the early allowance of the claims, Applicants have amended claims 1, 2, 8, 13, 14, 21, 22, and 25, as discussed above, to change the terms "comprising" and "comprises" to --consisting essentially of-- and --consists essentially of--, respectively. Therefore, the breadth and scope of claims 1, 2, 4 to 25, 30, and 31 are clearly defined by the transition "consisting essentially of" in those claims.

With regard to the allegation in the present Final Office Action that, “in simple terms . . . all there is to the invention . . .” is a mixture consisting essentially of an oxidizer and a fuel, Applicants submit that this statement is simply incorrect. There is more to the claimed invention than a mixture of oxidizer and fuel, as alleged in the present Final Office Action. The presently claimed low-temperature autoignition compositions are novel and non-obvious low temperature autoignition compositions that provide an autoignition reaction of the silver nitrate oxidizer composition and metal fuel when heated to the autoignition temperature of no more than about 232°C, where the amount of metal fuel relative to the silver nitrate oxidizer composition is at least stoichiometric, and the autoignition reaction of the metal fuel and the silver nitrate oxidizer composition provides the autoignition of the presently claimed compositions.

With regard to the recitations of “sufficiently intimately mixed” and “sufficient degree of contact” in claims 1 and 26, Applicants submit that at page 13, lines 13 to 32, the present specification teaches the relationship between the intimacy and homogeneity of the oxidizer and metal fuel mixture and the ease of autoignition. One of ordinary skill in the art would understand that the dictionary definition, i.e., the normal use, of the word intimate is close association or contact, and, thus, would understand the use of “sufficiently intimately mixed” and “sufficient degree of contact.” However, to facilitate the early allowance of the claims, Applicants submit that claims 1 and 26 have been amended to recite that the mixture of metal fuel and silver nitrate oxidizer composition has a mix intimacy and homogeneity sufficient between the silver nitrate oxidizer composition and the metal fuel to react in an autoignition reaction of metal fuel and silver nitrate oxidizer composition at an autoignition temperature of no more than about 232°C, thereby providing an autoignition composition having the autoignition temperature of no more than about 232°C, where heating the autoignition composition to the autoignition temperature results in a reaction between the silver nitrate and the metal fuel, thereby initiating the autoignition reaction. Support for the amendments may be found in the present specification at page 8, line 37, to page 9, line 3, page 9, lines 14 to 19, page 9, line 35 to page 10, line 18, and page 13, lines 7 to 9. Those recitations in the present claims are clearly not indefinite, and one of ordinary skill in the art following the teaching of the

present specification would be able to obtain the autoignition compositions of the presently claimed invention without undue experimentation. Applicants also submit that this definition of the presently claimed invention is consistent with the discussion of the invention set forth in the Rule 132 Declaration.

Moreover, Applicants submit that there is no inconsistency between the Rule 132 Declaration of Mr. Ludwig and the teaching of Scheffee et al. ("Scheffee"), as alleged in the present Final Office Action. Scheffee discloses a plasticized polyvinyl chloride binder as a fuel in which an inorganic oxidizer is dispersed. As the oxidizer is dispersed in the fuel of the gas generating compositions disclosed by Scheffee, the fuel and oxidizer are intimately mixed, i.e., are in close association or contact, and have a sufficient degree of contact to react. Thus, where the binder is a fuel, and is in contact with an oxidizer, it is the combination of the binder and the oxidizer composition that determine the autoignition temperature, as the autoignition reaction is between the binder and the oxidizer. If a secondary fuel, such as the metal in the compositions disclosed by Sammons, is also dispersed throughout the binder, that fuel will not have sufficient contact with the oxidizer to react with the oxidizer until after the initiation of the autoignition reaction between the binder and oxidizer, and, thus, does nothing to determine the autoignition temperature. That is, the metal fuel and oxidizer in compositions such as those disclosed by Sammons do not undergo an autoignition reaction that initiates combustion of the composition, as presently claimed.

As clearly set forth in the specification at page 9, line 24, to page 10, line 18, the driving force for the autoignition reaction between the silver nitrate oxidizer composition and the metal fuel is the relative activity of the metal ions in the silver nitrate based oxidizer composition and the atoms of the metal fuel. The autoignition reaction occurs when a composition in accordance with the presently claimed invention is heated to or near a phase change, such as a crystal structure rearrangement or a melting, eutectic, or peritectic point, where the oxidizer softens or melts producing a kinetically favorable environment for reaction with the metal. Present specification, page 14, lines 10 to 18. One of ordinary skill in the art will recognize that the autoignition reaction is an electrochemical reaction, also known as an oxidation-reduction reaction or a redox reaction,

and, thus, the relative reactivity of the metal and the metal ions in the silver nitrate oxidizer composition are determined from their relative positions in the activity or electromotive series. Page 9, line 35, to page 10, line 10. As set forth in the present specification, the electromotive series lists the reactivity of various elements based on their strength as reducing agents. That is, elements higher in the electromotive series are stronger reducing agents than elements lower in the series, and, thus, elements higher in the series reduce ions of elements lower in the series. Those of ordinary skill in the art will thus recognize that ions of elements lower in the series are stronger oxidizing agents, and will oxidize elements higher in the series. For the low temperature autoignition compositions of the presently claimed invention, when a phase change occurs at the autoignition temperature, the metal fuel is oxidized by the silver ion in the silver nitrate, and the silver ion is reduced by the metal, as the metal fuel is higher in the electromotive series than silver.

Therefore, one of ordinary skill in the art will understand that the fuels and oxidizers of the presently claimed compositions are selected based on their relative positions in the electromotive series. The presently claimed silver nitrate oxidizer compositions all contain silver nitrate, which, as is well known to those skilled in the art, is an ionic compound in which the silver metal has an oxidation state of +1. That is, the silver in the silver nitrate is in the form of a positive silver cation,  $\text{Ag}^{+1}$ , a strong oxidizing agent that is lower in the electromotive series than the metals recited in the claims, i.e., molybdenum, calcium, strontium, barium, titanium, zirconium, vanadium, niobium, tantalum, chromium, tungsten, manganese, iron, cobalt, nickel, copper, zinc, cadmium, tin, antimony, bismuth, aluminum, silicon. One of ordinary skill in the art will also recognize that, in the compositions of the presently claimed invention, the metal fuels have an oxidation state of 0. As silver is lower than the metal fuels in the electromotive series, at the autoignition temperature, a redox reaction occurs in which the silver cation oxidizes the metal fuel from its initial oxidation state of 0 to a higher, positive valence state, and is reduced to metallic silver, before being oxidized to silver oxide,  $\text{Ag}_2\text{O}$ , at the high temperature of the molten salt environment that results from the energy released by the autoignition reaction. Present specification, page 10, lines 14 to 16. For example, molybdenum metal,  $\text{Mo}^0$ , is oxidized to  $\text{Mo}^{+6}$  in the form of  $\text{MoO}_3$ . Present specification,

Example 1, page 17. Similarly, zinc metal,  $Zn^0$ , is oxidized to  $Zn^{+2}$  in the form of  $ZnO$ .

Example 2, page 17.

As will be clearly understood by those of ordinary skill in the art, energy released by the initial electrochemical reaction between the silver ion and the metal fuel of a composition of the presently claimed invention ignites the composition upon heating to its autoignition temperature. As discussed above, the electrochemical autoignition reaction occurs when a composition in accordance with the presently claimed invention is heated to or near a phase change, such as a crystal structure rearrangement or a melting, eutectic, or peritectic point, where the silver nitrate oxidizer composition is softened sufficiently to provide the kinetically favorable environment for reaction with the metal. Present specification, page 14, lines 10 to 18.

Clearly, in the presently claimed invention, the autoignition temperature is that at which the autoignition reaction between the metal fuel and silver nitrate oxidizer occurs, thereby initiating combustion of the composition. Therefore, as with Scheffe, the fuel and oxidizer, i.e., the metal fuel and silver nitrate oxidizer composition, must have sufficient contact, i.e., mix intimacy, to allow reaction of the metal fuel and silver nitrate oxidizer composition upon heating to the autoignition temperature. As will be recognized by those of ordinary skill in the art, where the metal fuel and silver nitrate oxidizer composition are not in physical contact, no autoignition reaction will occur between the fuel and oxidizer. One of ordinary skill in the art would recognize that a fuel/binder, such as that disclosed by Sammons, would prevent contact between a metal fuel and oxidizer, and, thus, would prevent the reaction of the metal fuel and oxidizer in an autoignition reaction that initiates combustion of the composition. Granted, all pyrotechnic compositions, such as those disclosed by Sammons, have an autoignition temperature. However, where a binder is present as a fuel, and the oxidizer is dispersed within the binder, the autoignition reaction is between the oxidizer dispersed in the binder and the binder, not between two ingredients that are separated by a binder.

The presently claimed invention provides low temperature autoignition compositions in which the metal fuel and oxidizer composition react in an autoignition reaction at an autoignition temperature of less than 232 °C that initiates combustion of the

composition, where the autoignition temperature of a particular composition can be lowered by adding an excess of metal fuel. That is, as the amount of metal fuel is increased from that required for a stoichiometric balance with the oxidizer composition. This requires contact between the metal fuel and the oxidizer that is not available when the metal fuel and oxidizer are dispersed in and separated by a binder. One of ordinary skill in the art would recognize that a binder, such as that disclosed by Sammons, would prevent contact between the metal fuel and oxidizer composition, such that any autoignition reaction will be determined by a reaction involving the binder, and not the metal fuel and oxidizer.

With regard to the Markush group recited in claim 1, Applicants submit that M.P.E.P. §2173.05(h) states

*Ex parte Markush* sanctions claiming a genus expressed as a group consisting of certain specified materials. Inventions in metallurgy, refractories, ceramics, pharmacy, pharmacology and biology are most frequently claimed under the Markush formula but purely mechanical features or process steps may also be claimed by using the Markush style of claiming. See *Ex parte Head*, 214 USPQ 551 (Bd. App. 1981); *In re Gaubert*, 524 F.2d 1222, 187 USPQ 664 (CCPA 1975); and *In re Harnisch*, 631 F.2d 716, 206 USPQ 300 (CCPA 1980). It is improper to use the term “comprising” instead of “consisting of.” *Ex parte Dotter*, 12 USPQ 382 (Bd. App. 1931).

The use of Markush claims of diminishing scope should not, in itself, be considered a sufficient basis for objection to or rejection of claims. However, if such a practice renders the claims indefinite or if it results in undue multiplicity, an appropriate rejection should be made.

Similarly, the double inclusion of an element by members of a Markush group is not, in itself, sufficient basis for objection to or rejection of claims. Rather, the facts in each case must be evaluated to determine whether or not the multiple inclusion of one or more elements in a claim renders that claim indefinite. The mere fact that a compound may be embraced by more than one member of a Markush group recited in the claim does not necessarily render the scope of the claim unclear. For example, the Markush group, “selected from the group consisting of amino, halogen, nitro, chloro and alkyl” should be acceptable even though “halogen” is generic to “chloro.”

The materials set forth in the Markush group ordinarily must belong to a recognized physical or chemical class or to an art-recognized class. However, when the Markush group occurs in a claim reciting a process or a combination (not a single compound), it is sufficient if the members of the group are disclosed in the specification to possess at least one property in common which is mainly responsible for their function in the claimed relationship, and it is clear from their very nature or from the prior art that all of them possess this property. While in the past the test for Markush-type claims was applied as liberally as possible, present practice which holds that claims reciting Markush groups are not generic claims (M.P.E.P. §803) may subject the groups to a more stringent test for propriety of the recited members. Where a Markush expression is applied only to a portion of a chemical compound, the propriety of the grouping is determined by a consideration of the compound as a whole, and does not depend on there being a community of properties in the members of the Markush expression.

Therefore, a Markush group claims a genus as a group of specified materials. A member of the Markush group need not be a specific species, but, instead, may be a sub-genus, as M.P.E.P. §2173.05(h) states that “[t]he materials set forth in the Markush group ordinarily must belong to a recognized physical or chemical class or to an art-recognized class,” and provides an example of a Markush group that is “selected from the group consisting of amino, halogen, nitro, chloro and alkyl.” The members of the Markush group must be “disclosed in the specification to possess at least one property in common which is mainly responsible for their function in the claimed relationship, and it is clear from their very nature or from the prior art that all of them possess this property,” and “the double inclusion of an element by members of a Markush group, [i.e., an overlap in members of the Markush group,] is not, in itself, sufficient basis for objection to or rejection of claims.”

In the present application, the components in addition to the silver nitrate in the silver nitrate oxidizer composition set forth in the Markush group each belong to a recognized chemical class, and are disclosed in the specification as possessing oxidizing properties, a property in common which is mainly responsible for their function in the claimed relationship. It is clear from their very nature and from the prior art that all of them possess this property. None of the components recited in the Markush group are of

“plural, indistinct or vague genus,” as alleged in the present Final Office Action at page 5. Any overlap in the members of the Markush group is not sufficient to render the claim indefinite to one of ordinary skill in the art, as a skilled artisan would understand what is claimed, particularly in light of the specification. Therefore, the Markush groups recited in the present claims, particularly that recited in claims 1 and 26, meet the requirements of M.P.E.P. §2173.05(h) and 35 U.S.C. §112, second paragraph..

With regard to the alleged alternative to silver nitrate, Applicants submit that one of ordinary skill in the art would understand that the presently claimed invention requires silver nitrate in the oxidizer composition, that there is no alternative to silver nitrate, and that the members of the Markush group recited in claim 1 are well known to those skilled in the art. However, to facilitate the early allowance of the claims, claim 1 has been amended to clarify that the presently claimed oxidizer consists essentially of silver nitrate and, optionally, at least one additional oxidizer component. That is, claim 1, as amended, recites a silver nitrate oxidizer composition consisting essentially of one of: (a) silver nitrate or (b) a comelt or mixture consisting essentially of silver nitrate and at least one additional component selected from the group consisting of those components recited in the claims, where the silver nitrate oxidizer composition has at least one of a crystalline phase transition, a melting point, a eutectic point, or a peritectic point at a temperature of no more than about 250°C. Again, the presently claimed low temperature autoignition compositions require silver nitrate. There is no alternative to silver nitrate, but, instead, in addition to silver nitrate, the silver nitrate oxidizer composition may further consist essentially of one or more of the components recited in the Markush group of claim 1.

With regard to the terms “complex salt nitrate,” “a dried,” and “hydrated nitrate,” rejected for the reasons set forth on page 5 of the present Final Office Action, Applicants submit that one of ordinary skill in the art would understand that the recitation of “a dried, hydrated nitrate” in the claims refers to just that, a hydrated nitrate that has been at least partially dried. The term does not refer to two different members of the Markush group, i.e., a “dried” and a “hydrated nitrate”. However, to remove any



possibility of confusion in this regard, Applicants have amended the claims to remove the comma between “a dried” and “hydrated nitrate.”

Moreover, the present specification at page 8, lines 16 to 30, states

It has also been determined using selected hydrated metal nitrates, such as  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$  and  $\text{Cu}(\text{NO}_3)_2 \cdot 2.5 \text{H}_2\text{O}$ , that hygroscopic, low melting point metal nitrates can be dehydrated and stabilized relative to moisture absorption by comelting with anhydrous metal nitrates, such as those described above. It is believed that many other low melting point, hydrated metal nitrates of the general formula  $\text{M}(\text{NO}_3)_x \cdot \text{YH}_2\text{O}$ , including, but not limited to, the nitrates of chromium, manganese, cobalt, iron, nickel, zinc, cadmium, aluminum, bismuth, cerium and magnesium, can also be dehydrated and stabilized relative to moisture absorption and rehydration by comelting with anhydrous metal nitrates, nitrites, chlorates and/or perchlorates. These comelts can be combined with metals to produce low temperature ( $80^\circ\text{C}$  to  $250^\circ\text{C}$ ) autoignition compositions.

Therefore, one of ordinary skill in the art would understand the term “dried hydrated nitrate” in light of the specification. In addition, the terms “complex salt nitrate” and “dried hydrated nitrate” are terms of art in chemistry, belonging to recognized chemical classes, and are disclosed in the specification as possessing oxidizing properties, a property in common which is mainly responsible for their function in the claimed relationship. The terms “complex salt nitrate,” i.e., a nitrate, comprising complex or multiple cations and/or anions, and “dried hydrated nitrate,” as defined above, would be understood by one of ordinary skill in the art, particularly in light of the specification. Examples of complex salt nitrates and dried hydrated nitrates are exemplified in the present specification at pages 7 and 8. Exemplified complex salt nitrates, i.e., nitrates containing complex or multiple cations and/or anions, include ceric ammonium nitrate,  $\text{Ce}(\text{NH}_4)_2(\text{NO}_3)_6$ , and zirconium oxide dinitrate,  $\text{ZrO}(\text{NO}_3)_2$ . Exemplified dried hydrated metal nitrates, i.e., nitrates that are normally complexed by water molecules, but are at least partially dehydrated, include calcium nitrate tetrahydrate,  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ , and cupric nitrate hemi-pentahydrate,  $\text{Cu}(\text{NO}_3)_2 \cdot 2.5\text{H}_2\text{O}$ , which, as set forth in the present specification at page 8, lines 16 to 30, are dehydrated and stabilized relative to moisture absorption by comelting with anhydrous metal nitrates.

The presence of examples 4 and 12, which formed a portion of the parent application, have allegedly caused confusion. Therefore, those examples have been deleted from the specification.

With regard to the stoichiometric requirement for the mixture of metal fuel and oxidizer, Applicants submit that one of ordinary skill in the art would understand that the recitation in the claims of “the metal fuel is present in an amount at least sufficient to provide a substantially stoichiometric mixture of metal fuel and oxidizer” means that the amount of metal fuel is stoichiometric relative to the amount of silver oxidizer composition. However, to facilitate the early allowance of the claims, Applicants have amended the claims to recite that the metal fuel is present in an amount at least substantially stoichiometric relative to the silver nitrate oxidizer composition. Therefore, one of ordinary skill in the art will recognize that the amount of metal fuel relative to the silver nitrate oxidizer composition is stoichiometric, or is in excess of an amount required to form a mixture in which the amount of metal fuel is stoichiometric relative to the silver nitrate oxidizer composition. Therefore, the recited stoichiometry only takes the claimed fuel and oxidizer composition into account. No other ingredients are taken into account in the stoichiometry of the autoignition reactions of the presently claimed compositions.

With regard to the rejection under 35 U.S.C. §112, first paragraph, as discussed above, the recitation in the claims regarding the mix intimacy and contact in the claims, as amended, is fully supported by the specification and claims, as originally filed. In particular, at page 13, lines 13 to 32, the present specification discusses the requirements for mix intimacy and homogeneity. Therefore, the specification does not lack basis for the terms recited in the claims.

With regard to the alleged lack of definition regarding the amounts and identity of ingredients, Applicants submit that the present specification clearly teaches one of ordinary skill in the art how to make and use the presently claimed invention without undue experimentation. First, the present specification, at page 17, line 4, to page 23, line 2, provides specific examples of low temperature autoignition compositions of the presently claimed invention having autoignition temperatures of  $118 \pm 2^\circ\text{C}$  to  $217 \pm 2^\circ\text{C}$ . The oxidizer compositions in each of the examples contains silver nitrate alone or in

combination with various other oxidizers. The metal fuels exemplified are Mo, Zn, and Mg. Each of the examples also provides the balanced chemical equation for the autoignition reaction of each of the examples, providing the stoichiometry for each reaction. The amount of each ingredient in percent by weight for each exemplified low temperature autoignition composition is also clearly set forth in each example. Therefore, the specification provides twelve (12) different compositions having autoignition temperatures over a range of about 99 °C. As the specification clearly teaches the requirements for mix intimacy and homogeneity, one of ordinary skill in the art can practice the presently claimed invention over the temperature range of the examples simply by using any of the exemplified compositions, and, thus, can practice the presently claimed invention without any experimentation. It is well established that an Applicant for a patent need not disclose or exemplify every possible embodiment of the claimed invention or claim everything that is disclosed. All that is required under 35 U.S.C. §112, first paragraph, is that the application teach one of ordinary skill in the art how to make and use the invention, and set forth the best mode for practicing the invention. The present specification clearly meets the requirements of 35 U.S.C. §112.

Second, at page 9, lines 35, to page 10, line 9, the present specification teaches that “the driving force for autoignition reactions follows the activity or electromotive series for metals in which a metal higher in the series will displace a metal lower in the series in a solution or melt.” This is the same driving force that causes copper to displace the ionic silver from a silver nitrate solution when a copper wire is placed in the solution, such that the copper ionizes, and, thus, enters the solution, forming copper nitrate, and the ionic silver in the solution precipitates as metallic silver on the wire. Therefore, to determine which metals, in addition to those listed at page 10, line 8, are useful in the presently claimed invention, one of ordinary skill in the art would only need to consult a reference text to find which metals in the electromotive series will displace silver from silver nitrate to determine other metals that are useful in the presently claimed compositions. This cannot be considered undue experimentation.

Third, the claims recite and the specification clearly discloses that the stoichiometry takes into account the oxidizer composition and metal fuel only. Therefore,

to practice the presently claimed invention using a metal fuel/silver nitrate oxidizer composition combination not specifically exemplified in the present specification, one of ordinary skill in the art would only need to write the balanced chemical equation for a particular combination of metal fuel and silver nitrate oxidizer composition. That equation would provide the stoichiometry for the reaction, and, thus, the relative molar amounts of each ingredient required for the composition. A standard test using a differential scanning calorimeter ("DSC") could be used to determine the autoignition temperature. In addition, one of ordinary skill in the art would be able to use the DSC to determine which combinations of oxidizers in a silver nitrate oxidizer composition would have at least one of a crystalline phase transition, a melting point, a eutectic point, or a peritectic point at a temperature of no more than about 250°C. One of ordinary skill in the art would be able to determine the stoichiometry for autoignition compositions having multiple oxidizers in the silver nitrate oxidizer composition. The determination of the amount of each ingredient required for a stoichiometric mixture requires a trivial calculation for one of ordinary skill in the art, and does not require undue experimentation.

Fourth, the present specification, at page 11, lines 34 and 35, and claim 18 recite that when the amount of Mo fuel is increased above the stoichiometric amount, i.e., the amount determined from the balanced autoignition equation, the autoignition temperature decreases. The specification, at page 11, lines 35 and 36, also states that it is believed that other metals demonstrate the same effect when present in excess of the stoichiometric amount. An example of how the stoichiometry of the reactions change with increasing amounts of excess metal fuel as a mixture becomes increasingly under oxidized or fuel rich is also provided at page 22, lines 14 to 32. Therefore, one of ordinary skill in the art would understand that once an autoignition temperature has been determined for a stoichiometric mixture of metal fuel and silver nitrate oxidizer composition, a composition having a lower autoignition temperature may be obtained by adding metal fuel in excess of the stoichiometric amount. The autoignition temperature of that composition can then be determined with a simple DSC test.

Finally, the statement in the present Final Office Action, "the specification does not reasonably enable one of ordinary skill in to practice the invention as broadly

claimed, lacking amounts, ratios, etc., to obtain the desired performance claimed,” is clearly incorrect. The specification clearly teaches and the claims recite that the metal fuel is present in an amount at least substantially stoichiometric relative to the silver nitrate oxidizer composition. Therefore, one of ordinary skill in the art would understand that, in the low temperature autoignition compositions of the invention, the metal fuel is either present in an amount at least sufficient to provide a stoichiometric mixture of metal fuel and silver nitrate oxidizer composition, such that the amount of metal fuel relative to the silver nitrate oxidizer composition is stoichiometric, or the amount of metal fuel is in excess of an amount required to form a mixture in which the amount of metal fuel is stoichiometric relative to the silver nitrate oxidizer composition. Therefore, in light of the specification, one of ordinary skill in the art would understand that the stoichiometry of the presently claimed low temperature autoignition compositions is with regard to the metal fuel and silver nitrate oxidizer composition only, and that the autoignition compositions of the claimed invention have a readily determined autoignition temperature, which can be decreased by simply increasing the amount of metal fuel relative to the amount required to have a stoichiometric mixture with the oxidizer composition. One of ordinary skill in the art could easily determine the stoichiometry, and, thus, the required amounts of fuel and oxidizer for a particular metal and silver nitrate oxidizer composition. Again, this requires no undue experimentation.

Therefore, the amendment of the claims to change “comprising” to --consisting essentially of-- and “comprises” to --consists essentially of-- renders much of the rejection under 35 U.S.C. §112 moot, and, thus, as the claims particularly point out and distinctly claim the subject matter that Applicants regard as the invention, and the specification describes the claimed invention in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed, the present claims and specification meet the requirements of 35 U.S.C. § 112, first and second paragraphs. Accordingly, it is respectfully requested that the Examiner withdraw the rejections of claims 1, 13 to 18, and 25 to 32 under 35 U.S.C. §112, first and second paragraphs.

With regard to the rejection of the claims over the prior art in which the claims were read as being of a broad comprising scope, Applicants submit that, where required, claims 1, 2, and 4 to 25 have been amended to change “comprising” to “--consisting essentially of--” and to change “comprises” to “--consists essentially of--”. Therefore, those claims must be examined as being of that scope. Applicants also submit that all the rejections of the claims based on the alleged scope of the claims are rendered moot. Moreover, for the reasons set forth below, the present claims are patentable over the cited prior art references, as the claims clearly recite elements that distinguish the presently claimed invention from the prior art.

Before addressing the specific rejections over the prior art, Applicants believe that the allegation at page 8 in the present Final Office Action that “[t]he references teach and suggest compositions which would appear to inherently autoignite at low temperatures” (emphasis added), must also be addressed, as that allegation does not meet the requirements for an inherency rejection, as set forth in M.P.E.P. §2112, which states:

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art); *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). “To establish inherency, the extrinsic evidence ‘must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.’ ” *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (citations omitted) (The claims were drawn to a disposable diaper having three fastening elements. The reference disclosed two fastening elements that could perform the same function as the three fastening elements in the claims. The court construed the claims to require three separate elements and held that the reference did not disclose a separate third fastening element, either expressly or inherently.).

In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the

determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.” *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original) (Applicant’s invention was directed to a biaxially oriented, flexible dilation catheter balloon (a tube which expands upon inflation) used, for example, in clearing the blood vessels of heart patients). The examiner applied a U.S. patent to Schjeldahl which disclosed injection molding a tubular preform and then injecting air into the preform to expand it against a mold (blow molding). The reference did not directly state that the end product balloon was biaxially oriented. It did disclose that the balloon was “formed from a thin flexible inelastic, high tensile strength, biaxially oriented synthetic plastic material.” *Id.* at 1462 (emphasis in original). The examiner argued that Schjeldahl’s balloon was inherently biaxially oriented. The Board reversed on the basis that the examiner did not provide objective evidence or cogent technical reasoning to support the conclusion of inherency.).

The present Final Office Action only states that the compositions disclosed in the cited references “would appear to inherently autoignite at” the presently claimed autoignition temperature. The present Final Office Action does not provide any objective evidence or cogent technical reasoning to support the conclusion of inherency, and does not provide any evidence that one of ordinary skill in the art would recognize the presence of the allegedly inherent properties of the presently claimed invention in the cited references. Without support, the present Final Office Action merely makes an allegation that all of the prior art references disclose compositions that appear to have an autoignition temperature of no more than about 232°C and an oxidizer having at least one of a crystalline phase transition, a melting point, a eutectic point, or a peritectic point at a temperature of no more than about 250°C, as presently claimed. The fact that the compositions disclosed by the cited references may have the presently claimed autoignition temperature is not sufficient to establish that the autoignition temperature and crystalline phase transition, a melting point, a eutectic point, or a peritectic point recited in the present claims is a necessary result of the disclosure of the cited references, such that those claim elements are inherent to the cited prior art, or that they would be recognized by one of ordinary skill in the art. As stated in M.P.E.P. §2112, for the presently claimed low temperature autoignition compositions to be rendered obvious by the cited prior art, there must be evidence that

makes clear that the presently claimed autoignition temperature and crystalline phase transition, a melting point, a eutectic point, or a peritectic point are necessarily present in the compositions described in the references, and that it would be so recognized by one of ordinary skill in the art. Inherency of the presently claimed autoignition temperature and crystalline phase transition, a melting point, a eutectic point, or a peritectic point cannot be established by mere probabilities or possibilities. Instead, evidence must be provided that the presently claimed autoignition temperature and crystalline phase transition, a melting point, a eutectic point, or a peritectic point are a necessary result of the teaching of the prior art, and that those claimed elements were recognized by those of skill in the art as necessarily being present in the compositions disclosed by the cited prior art. The mere fact that the autoignition temperature and crystalline phase transition, a melting point, a eutectic point, or a peritectic point may result from the teaching of the prior art is not sufficient.

In addition, the compositions disclosed in the cited references are not “the same or only slightly different” from the presently claimed low temperature autoignition compositions, as alleged in the present Final Office Action. In addition to having an autoignition temperature of no more than about 232°C and a crystalline phase transition, a melting point, a eutectic point, or a peritectic point at a temperature of no more than about 250°C, the present claims recite that the mixture of metal fuel and silver nitrate oxidizer composition has a mix intimacy and homogeneity sufficient between the silver nitrate oxidizer composition and the metal fuel to react in an autoignition reaction of metal fuel and silver nitrate oxidizer composition at an autoignition temperature of no more than about 232°C, thereby providing an autoignition composition having the autoignition temperature of no more than about 232°C, where heating the autoignition composition to the autoignition temperature results in a reaction between silver nitrate and the metal fuel, thereby initiating the autoignition reaction. Therefore, compositions that prevent contact between a silver nitrate oxidizer composition and a metal fuel cannot autoignite as result of a reaction between the silver nitrate and the metal fuel that initiates combustion of the composition.



Moreover, the mere fact all pyrotechnic compositions will autoignite when heated to a sufficiently high temperature, and, thus, an autoignition temperature is inherent to all pyrotechnic compositions in the prior art is not relevant to the patentability of the present claims. The cited references do not disclose or even suggest autoignition compositions that undergo the autoignition reactions of the presently claimed compositions at the claimed temperature of no more than about 232°C, and fail to disclose or even suggest a silver nitrate oxidizer composition having at least one of a crystalline phase transition, a melting point, a eutectic point, or a peritectic point at a temperature of no more than about 250°C in such an autoignition composition. That is, to be relevant to the patentability of the present claims, the prior art references must disclose or at least suggest autoignition compositions having each of the claimed elements of the presently claimed invention, and provide motivation for those of ordinary skill in the art to obtain the presently claimed compositions. As discussed below, the prior art references cited in the present Final Office Action do not disclose or even suggest the presently claimed compositions, and fail to provide any motivation to one of ordinary skill in the art to obtain the presently claimed compositions.

Claims 1, 13 to 18, and 26 to 32 were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Sammons et al. ("Sammons") in view of Sidebottom, Garner et al. ("Garner"), Healy, and Ellern et al. ("Ellern") for the reasons set forth on page 2 of the present Final Office Action dated September 13, 2000, and incorporated by reference on page 8 of the present Final Office Action.

In response, Applicants submit that the presently claimed invention is directed to a low temperature autoignition composition for safely initiating combustion of a main pyrotechnic charge in a gas generator or pyrotechnic device exposed to flame or a high temperature environment. Claim 1 recites that the autoignition composition consists essentially of a mixture of a silver nitrate oxidizer composition and a powdered metal fuel. The silver nitrate oxidizer composition consists essentially of one of (a) silver nitrate or (b) a comelt or mixture consisting essentially of silver nitrate and at least one additional component selected from the group consisting of an alkali metal nitrate, an alkaline earth metal nitrate, a complex salt nitrate, a dried, hydrated nitrate, an alkali metal chlorate, an

alkali metal perchlorate, an alkaline earth metal chlorate, an alkaline earth metal perchlorate, ammonium perchlorate, sodium nitrite, potassium nitrite, silver nitrite, a complex salt nitrite, a solid organic nitrate, and a solid organic nitrite. The powdered metal fuel is selected from the group consisting of molybdenum, calcium, strontium, barium, titanium, zirconium, vanadium, niobium, tantalum, chromium, tungsten, manganese, iron, cobalt, nickel, copper, zinc, cadmium, tin, antimony, bismuth, aluminum, silicon, and mixtures thereof. The silver nitrate oxidizer composition has at least one of a crystalline phase transition, a melting point, a eutectic point, or a peritectic point at a temperature of no more than about 250°C, and the metal fuel is present in an amount at least substantially stoichiometric relative to the silver nitrate oxidizer composition. The mixture of metal fuel and silver nitrate oxidizer composition has a mix intimacy and homogeneity sufficient between the silver nitrate oxidizer composition and the metal fuel to react in an autoignition reaction of metal fuel and silver nitrate oxidizer composition at an autoignition temperature of no more than about 232°C, thereby providing an autoignition composition having the autoignition temperature of no more than about 232°C. Heating the autoignition composition to the autoignition temperature results in a reaction between the silver nitrate and the metal fuel, thereby initiating the autoignition reaction.

As recited in claim 26, the low temperature autoignition composition comprises a mixture of a silver nitrate oxidizer composition and a powdered metal fuel, where the silver nitrate oxidizer composition comprises a mixture or a comelt comprising silver nitrate and at least one additional component selected from the group consisting of an alkali metal nitrate, an alkaline earth metal nitrate, a complex salt nitrate, a dried hydrated nitrate, silver nitrate, an alkali metal chlorate, an alkali metal perchlorate, an alkaline earth metal chlorate, an alkaline earth metal perchlorate, ammonium perchlorate, sodium nitrite, potassium nitrite, silver nitrite, a complex salt nitrite, a solid organic nitrate, and a solid organic nitrite. The metal fuel is present in an amount at least substantially stoichiometric relative to the silver nitrate oxidizer composition, and the mixture of metal fuel and silver nitrate oxidizer composition has a mix intimacy and homogeneity sufficient in the composition between the silver nitrate oxidizer composition and the metal fuel to react in an autoignition reaction of metal fuel and silver nitrate oxidizer composition at an

autoignition temperature of no more than about 232°C, thereby providing an autoignition composition having the autoignition temperature of no more than about 232°C, where heating the autoignition composition to the autoignition temperature results in a reaction between silver nitrate and the metal fuel, thereby initiating the autoignition reaction.

As discussed in the Declaration of Christopher P. Ludwig, submitted with the Preliminary Amendment dated May 19, 2000, the mix intimacy of the fuel and oxidizer is required in the present invention to provide the contact between the claimed oxidizer and metal fuel necessary to obtain proper autoignition of the presently claimed compositions. In particular, the Declaration states at paragraph 5, "The intimate mixing of the fuel and oxidizer is required in the present invention to provide the contact between the oxidizer and the metal fuel that is necessary to obtain proper autoignition, as the reaction or burning rate and ease of autoignition of the compositions of the invention increase as mix intimacy and homogeneity increases." (Emphasis added). As discussed above, where the metal fuel and oxidizer composition are not in contact, heating the composition will not result in an autoignition reaction of the metal fuel and oxidizer that initiates combustion of the composition.

In contrast, Sammons discloses solid propellant compositions incorporating a binder that reportedly overcomes the deficiencies of both double-base and composite propellants, which use a metal and an oxidizer dispersed in a matrix. Column 1, lines 1 to 75. The binder is based upon a linear polymethylenenitramine having the formula  $-\text{CH}_2-\text{N}(\text{NO}_2)-$ , which is represented as Z. Column 2, lines 1 to 8. The monomers used to form the final polymeric binder are of the formula  $\text{R}-\text{Z}_x-\text{CH}_x-\text{R}$ , where X is 2 to 6, and R is a functional group capable of a polymerization reaction, such as a substituted alkoxy group, which results in an ether linkage in the final product. Column 2, lines 9 to 41. One of ordinary skill in the art will recognize that such a polymeric compound has portions that will function as a fuel and portions that will function as an oxidizer when a propellant based on the binder is ignited. The preferred monomer is referred to as TNDE. Column 4, lines 1 to 12. The solid propellants disclosed by Sammons are formed by blending the binder ingredients with a metal and an oxidizer, and casting the propellant. Column 7,

Example II. Therefore, the disclosed propellant contains a metal fuel, an oxidizer, and a binder that, upon ignition, functions as both a fuel and an oxidizer.

At column 6, lines 18 to 21, Sammons teaches that

Since the propellant composition is required to withstand high-temperature storage, it is preferable that the melting point and the decomposition temperatures of the oxidizer be as high as possible.

The oxidizers disclosed by Sammons are perchlorates and nitrates, where silver perchlorate is particularly disclosed, but silver nitrate is not. The decomposition temperature of silver perchlorate, according to the Merck Index, Twelfth Edition, 1996, is 486°C. In contrast, the melting point of silver nitrate is only 212°C. Copies of the appropriate pages for the Merck Index are attached for the convenience of the Examiner. Moreover, the majority of oxidizers disclosed by Sammons have a melting point or decomposition temperature of at least 350°C. Therefore, one of ordinary skill in the art, following the teaching of Sammons, would understand that the disclosed propellants should have high temperature stability, and would not be motivated to use an oxidizer composition having a melting point, a eutectic point, or a peritectic point at a temperature of no more than about 250°C, as presently claimed.

In addition, the present claims, as amended, recite that heating the autoignition composition to the autoignition temperature results in a reaction between silver nitrate and the metal fuel, thereby initiating the autoignition reaction.

In contrast, in the propellant compositions disclosed by Sammons, the oxidizer and the metal fuel are dispersed in a polymer matrix that will function as both a fuel and an oxidizer when the propellant is ignited. Sammons does not disclose or even suggest that the disclosed propellants have an autoignition temperature of no more than about 232°C, or that heating the propellant to a temperature of no more than about 232°C will result in an autoignition reaction between the metal fuel and oxidizer. Moreover, Sammons discloses nothing that would indicate to one of ordinary skill in the art that any of the presently claimed autoignition temperature and autoignition reaction of the metal and oxidizer or the crystalline phase transition, melting point, eutectic point, or peritectic point at a temperature of no more than about 250°C of the presently claimed silver nitrate

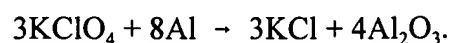
oxidizer composition are a necessary result of the teaching of Sammons. Therefore, the recitations of those properties of the invention in the present claims are not inherent to Sammons.

Moreover, as stated in the Rule 132 Declaration, contact between the metal fuel and silver nitrate oxidizer composition is required to obtain autoignition of the metal fuel and silver nitrate oxidizer composition. One of ordinary skill in the art will recognize that without physical contact, two chemical compositions cannot react. As the present claims recite heating the autoignition composition to the autoignition temperature results in a reaction between silver nitrate and the metal fuel, thereby initiating the autoignition reaction, those two compositions must be in physical contact. Such as reaction between silver nitrate and the metal fuel is clearly not a necessary result of the teaching of Sammons. Moreover, is a near certainty that such an autoignition reaction between the metal and oxidizer does not ever occur when a composition in accordance with the teaching of Sammons is heated to its autoignition temperature.

Moreover, the only oxidizer used in the examples disclosed by Sammons is ammonium perchlorate, which decomposes at about 380°C, a temperature that is significantly higher than the presently claimed 250°C. This further distinguishes the composite propellants disclosed by Sammons from the low temperature autoignition materials of the invention. Therefore, Sammons does not disclose or even suggest the presently claimed invention, and provides no motivation to obtain the present invention. In addition, the autoignition temperature, autoignition reaction, and oxidizer composition crystalline phase transition, melting point, eutectic point, and peritectic point at a temperature of no more than about 250°C recited in the present claims are not inherent in propellant compositions made in accordance with the teachings of Sammons.

The other cited references do nothing to overcome the deficiencies of Sammons. Sidebottom teaches gas generating compositions comprising an alkali or alkaline earth metal azide, an oxidizing compound, and an oxide of silicon, aluminum, titanium, tin, or zinc with or without an admixture with silicon, aluminum, titanium, tin, or zinc metal, where the oxide and the metal, if present, are present in amounts sufficient to react with metallic oxides produced during the decomposition of the azide. Column 1,

lines 44 to 51. The oxidizers disclosed at column 2, line 58, to column 3, line 4, include silver nitrate, but not silver perchlorate. Thus, Sidebottom does not teach any equivalency between silver nitrate and silver perchlorate, and provides no motivation to replace the silver perchlorate disclosed by Sammons with silver nitrate. The only example of a composition containing a metal is example 8, which contains sodium azide, aluminum, and potassium chlorate in molar proportions of 2:2:1. Column 4, lines 45 and 46. The balance equation for the reaction of aluminum and potassium perchlorate is



Therefore, as the stoichiometric ratio of Al to  $\text{KClO}_4$  is 8 to 3, i.e., 2.5 to 1, and the ratio of metal to oxidizer in the composition disclosed by Sidebottom in example 8 is 2 to 1, Sidebottom fails to disclose a low temperature composition, having a metal fuel present in an amount at least sufficient to provide a substantially stoichiometric mixture of the metal and oxidizer, where the amount of metal is stoichiometric relative to the oxidizer, as presently claimed. Moreover, Sidebottom clearly teaches that the sodium azide reacts with the oxidizer, column 2, lines 31 to 52, and the metal reacts with the metal oxides formed during the decomposition of the azide. Therefore, Sidebottom teaches a reaction between the oxidizer and the azide, not between the metal and the oxidizer as presently claimed, and, thus, Sidebottom does not disclose or even suggest a composition that, upon heating to an autoignition temperature of no more than about 232°C, an autoignition reaction between the oxidizer and the metal is initiated that initiates combustion of the composition.

Moreover, the only oxidizers exemplified by Sidebottom are potassium perchlorate and potassium chlorate, which have melting points of 400°C and 368°C, respectively. As a result, those oxidizers do not have at least one of a crystalline phase transition, a melting point, a eutectic point, or a peritectic point at a temperature of no more than about 250°C, as presently claimed, and, thus, the exemplified compositions cannot have the presently claimed autoignition temperature of no more than about 232°C.

Garner '253 teaches the use of starch as a fuel/binder in pyrotechnic gas generating compositions, such as those used as gas generants in inflatable safety restraints. Column 1, lines 8 to 11. As with Sidebottom, Garner '253 discloses silver nitrate as a useful nitrate oxidizer, column 2, lines 14 to 33, but does not include silver perchlorate

among the listed perchlorates, and, thus, provides no motivation to replace the silver perchlorate oxidizer disclosed by Sammons with silver nitrate. Therefore, Garner '253 does not disclose or even suggest the presently claimed invention.

Healy teaches a melt-in-fuel emulsion comprising a melt of ammonium nitrate as the discontinuous phase and a non-metallic fuel as the continuous phase. Column 1, lines 9 and 10. The fuel is a water-insoluble non-self-explosive fuel selected from the group consisting of hydrocarbons, halogenated hydrocarbons, and mixtures thereof. Column 1, line 66, to column 2, line 9. No metal fuel is disclosed by Healy. Healy discloses compositions containing non-metallic fuels, and, thus, fails to provide any motivation to use any of the disclosed oxidizers with a metal fuel.

As discussed in the Rule 132 Declaration in paragraph 9, the Final Office Action dated January 20, 2000, states that Ellern, at pages 296 to 300, teaches,

[T]he melting point and decomposition temperature of silver nitrate, and discusses the reaction of solid fuels with solid oxidizers as related to melting temperature. This would seem to suggest the relatively low decomposition or autoignition (spontaneous ignition) temperature of such compositions.

The Office Action dated September 13, 2000, incorporated by reference in the present Final Office Action, also makes that same statement. However, the teachings of Ellern must be taken in context. That is, Ellern specifically states, in the sentence bridging pages 296 and 297, that there is a scarcity of systematic data regarding the initiation temperature of fuel-oxidizer mixtures that restricts general statements. Although Ellern teaches that the melting point of silver nitrate is 214°C, in Tables 29 and 30, Ellern only discloses metal/oxidizer binary mixtures and ignition mixtures having initiation temperatures of at least 300°C. Such an autoignition temperature of 300° is, of course, outside the scope of the present claims, and, thus, does nothing to disclose or even suggest the presently claimed invention. Moreover, as with the other secondary references, substituting the silver nitrate oxidizer disclosed by Ellern for the oxidizer disclosed by Sammons et al. would not provide the present invention.

Even if the teachings of Sammons were combined with the teachings of any or all of the other cited references, the combination would not provide the presently

claimed low temperature autoignition compositions. Instead, the combination would provide a propellant in which the oxidizer and fuel are dispersed throughout a binder matrix, having high temperature stability, in which, upon heating, the binder and oxidizer would first react in an autoignition reaction. Therefore, the combination would not provide an autoignition composition having an autoignition temperature of no more than about 232°C, where heating the autoignition composition to the autoignition temperature results in a reaction between silver nitrate and the metal fuel, thereby initiating the autoignition reaction. As a result, the cited references provide no motivation to one of ordinary skill in the art to obtain the presently claimed invention.

Therefore, as Sammons, Sidebottom, Garner '253, Healy, and Ellern, whether taken alone or in combination do not disclose or even suggest the presently claimed invention, and fail to provide any motivation to one of ordinary skill in the art to obtain the presently claimed invention, the present claims are not obvious over any or all of those references. Accordingly, it is respectfully requested that the Examiner withdraw the rejection of claims 1, 13 to 18, and 26 to 32 under 35 U.S.C. §103(a).

Claims 1, 13 to 18, and 26 to 32 were rejected under 35 U.S.C. §103(a) as being unpatentable over Halliday et al. ("Halliday") in view of Tepper and Ellern for the reasons set forth on page 2 and 3, of the Office Action dated September 13, 2000, and incorporated by reference on page 9 of the present Final Office Action, and claims 1, 13 to 15, and 26 to 32 were rejected under 35 U.S.C. §103(a) as being unpatentable over Halliday for the reasons set forth on page 5 of the Office Action dated September 13, 2000, and incorporated by reference on page 9 of the present Final Office Action.

In response, as discussed in paragraph 10 of the Rule 132 Declaration, Halliday teaches explosive "water-in-fuel" and "melt-in-fuel" emulsions. Abstract and column 1, lines 12 to 16. The disclosed emulsions for use as a cartridge explosive comprise an oxidizer as the discontinuous phase, a fuel as the continuous phase, and a density reducing agent. Column 1, lines 17 to 33. The fuel should be substantially solid at ambient temperature, but should also have a softening point above ambient temperature. Column 1, lines 41 to 49. Typical fuels include waxes, oils, liquid paraffin, xylene, toluene, petroleum, and dinitrotoluene. Column 1, lines 57 to 59, and column 3, lines 11 to



18. The softening point of the fuel should be above 35°, so that the fuel has a low viscosity at 85° to 95°C. Column 1, lines 59 to 62. Clearly, the fuels disclosed by Halliday are not metals, and, thus, are outside the scope of the present claims.

Although Halliday does disclose that a solid fuel, such as atomized aluminum, may be blended together with the density reducing agent, column 1, lines 37 to 40, Halliday fails to disclose or suggest that the aluminum fuel is present in an amount at least substantially stoichiometric relative to the silver nitrate oxidizer composition. Instead, Halliday teaches that the disclosed explosive emulsions typically comprise 75 to 95 weight percent oxidizer, 3.2 to 6.5 weight percent fuel, and 0.95 to 2.0 weight percent emulsifier. Column 3, lines 41 to 45. The amount of aluminum disclosed in the examples ranges from 3.5 to 6 percent by weight, and the amount of ammonium nitrate, sodium nitrate, and sodium nitrite oxidizers range from 72.86 to 79.58 percent by weight, 11.97 to 13.07 percent by weight, and 0 to 0.9 weight percent, respectively. Column 11, line 14 to column 12, line 29. The balanced equation for the reaction of ammonium nitrate and aluminum is



which requires over 18 percent by weight aluminum for a stoichiometric reaction, the balanced equation for the reaction between sodium nitrate and aluminum is



which requires over 34 percent by weight aluminum for a stoichiometric reaction, and the balanced equation for the reaction between sodium nitrite and aluminum is



which requires about 28 weight percent aluminum for a balanced stoichiometric reaction.

Therefore, the amount of metal fuel disclosed by Halliday is significantly less than an amount at least substantially stoichiometric relative to the oxidizer, as presently claimed. This clearly distinguishes the presently claimed invention from the explosives disclosed by that reference. Therefore, Halliday does not disclose or even suggest the presently claimed invention.

Tepper and Ellern do nothing to overcome the deficiencies of Halliday. Tepper teaches castable pyrotechnic compositions comprising powdered metal dispersed in

a low-melting metal nitrate or metal chlorate oxidizer. Column 1, lines 1 to 22. The powdered metal is dispersed in a melt of the oxidizer to form a slurry during the casting process. Column 1, lines 36 to 42. The metals must not be so finely divided that they will react spontaneously when mixed with the molten oxidizing salts. Column 1, lines 49 to 51. Therefore, Tepper teaches away from the compositions of the presently claimed invention, which autoignite if the silver oxidizer melts, and, thus, the combination of Tepper with any other reference is improper. The only oxidizer melt disclosed by Tepper is a melt of potassium nitrate, sodium nitrate, and lithium nitrate that is maintained at a temperature of 150°C, which is 30°C above the melting point of the eutectic mixture. Column 2, lines 61 to 67. Powdered magnesium fuel is added to the melt. Clearly, this composition is not within the scope of the presently claimed invention, as melted eutectic mixture of magnesium and the disclosed oxidizers does not autoignite, as would a composition in accordance with the invention.

Moreover, even if the teachings of Tepper and Halliday were combined, such that the metal fuels of Tepper were used in the emulsions of Halliday, the combination would not provide the presently claimed invention. Instead, one would obtain an explosive "water-in-fuel" or "melt-in-fuel" emulsion, comprising a discontinuous oxidizer phase, a continuous fuel continuous phase, a density reducing agent, and, optionally, a metal fuel. The amount of metal fuel used would be significantly less than the amount required to provide a stoichiometric mixture of metal fuel and oxidizer, as presently claimed.

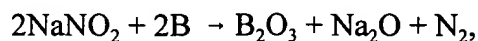
In Table 19, as stated in the Office Action dated September 13, 2000, incorporated by reference in the present Final Office Action, Ellern teaches the melting points and eutectics of various nitrates and mixtures of various nitrates. The melting points and eutectics of the nitrates and mixtures range from 52° to 561°C. However, Ellern does not provide any motivation to one of ordinary skill in the art to select any particular nitrate or nitrate mixture, and, thus, does not disclose or even suggest the presently claimed low temperature autoignition compositions, which have autoignition temperatures of no more than about 232°C.

Moreover, even if the teachings of Ellern were combined with that of Halliday, the combination would not provide the presently claimed invention. Instead, one would obtain an explosive "water-in-fuel" or "melt-in-fuel" emulsion, comprising a discontinuous oxidizer phase, a continuous fuel continuous phase, a density reducing agent, and, optionally, a metal fuel. The amount of metal fuel used would be significantly less than the amount required to provide a stoichiometric mixture of metal fuel and oxidizer, as presently claimed.

Therefore, as Halliday, Tepper, and Ellern, whether taken alone or in combination, do not disclose or suggest the presently claimed invention, and fail to provide any motivation to obtain the invention, the present claims are not obvious. Accordingly, it is respectfully requested that the Examiner withdraw the rejections of claims 1, 13 to 18, and 26 to 32 under 35 U.S.C. §103(a).

Claims 1, 13 to 18, and 26 to 32 were rejected under 35 U.S.C. §103(a) as being unpatentable over Poole et al. ("Poole") '380 in view of Ferrando et al. ("Ferrando"), Katzakian et al. ("Katzakian"), Halliday et al. ("Halliday"), and Yabsley et al. ("Yabsley") for the reasons set forth on pages 4 and 5 of the Office Action dated September 13, 2000, and incorporated by reference on page 9 of the present Final Office Action.

In response, as discussed in Mr. Ludwig's Rule 132 Declaration in paragraph 15, Poole discloses ignition compositions for inflator gas generators that comprise HNTO and an oxidizer, where HNTO is the hydrazine ( $H_2NNH_2$ ) salt of 3-nitro-1,2,4-triazole-5-one, otherwise known as nitrotriazolone ("NTO"). Optionally, the disclosed compositions may also include a metal additive, as a booster ignition material. Poole fails to disclose or suggest that the metal additive is present in an amount at least substantially stoichiometric relative to the oxidizer, as is required in the present claims. The only composition exemplified by Poole that includes an additive that arguably could be considered at least partially metallic contains 78 percent HNTO and 18 percent sodium nitrite, but only 2 percent boron. The balanced chemical equation for the reaction of sodium nitrite and boron is



which requires more than 10 percent by weight boron for a stoichiometric reaction, an amount of boron five times greater than the amount disclosed by Poole. However, one of ordinary skill in the art would not consider boron to be a metal. Therefore, the compositions disclosed by Poole are outside the scope of the presently claimed low temperature autoignition compositions, and one of ordinary skill in the art following the teaching of Poole would not be motivated to obtain autoignition compositions in which metal fuel is present in an amount at least substantially stoichiometric relative to the oxidizer.

The other cited references do nothing to overcome the deficiencies of Poole. Substituting the oxidizers taught in the secondary references for the oxidizer disclosed by Poole would not provide the presently claimed invention, as the resulting composition would not contain a metal in an amount at least substantially stoichiometric relative to the oxidizer.

Yabsley discloses oxidizers, such as ammonium nitrate and silver nitrate, for use in melt-in-fuel explosives that comprise a continuous organic fuel phase and a discontinuous oxidizer phase. Column 1, lines 46 to 53. However, using the oxidizers disclosed by Yabsley in the compositions disclosed by Poole would not provide the presently claimed invention. Instead, one of ordinary skill in the art following the teachings of Poole in view of Yabsley would obtain a composition containing HNT0 and an oxidizer and, perhaps, an amount of metal significantly less than an amount at least substantially stoichiometric relative to the oxidizer.

Ferrando discloses silver-coated boron carbide particles for reinforcing certain metal alloy matrices. Column 2, lines 57 to 60, and column 3, lines 1 to 5. The pyrophoric reaction cited in the Office Action dated September 13, 2000, incorporated by reference into the present Final Office Action, is between silver nitrate and boron carbide particles, and occurs during the coating process. However, boron carbide,  $B_4C$ , is not HNT0 or a metal, and, thus, Ferrando fails to provide any motivation to one of ordinary skill in the art to use silver nitrate as an oxidizer in the compositions disclosed by Poole, or to obtain the presently claimed autoignition compositions. Moreover, even if one of ordinary skill in the art did substitute silver nitrate for the oxidizers disclosed by Poole, it

would not provide the presently claimed invention. Instead, it would provide a composition containing HNT0 and silver nitrate and, perhaps, an amount of metal significantly less than an amount at least substantially stoichiometric relative to the oxidizer.

Katzakian discloses gas generator propellants that contain a polymeric binder blended with an ammonium nitrate based eutectic. Column 1, lines 53 to 67, and the Abstract. However, Katzakian does not disclose or even suggest an autoignition composition in which the metal fuel is present in an amount at least substantially stoichiometric relative to the oxidizer. Moreover, even if the teachings of Katzakian and Poole were combined, this combination would not provide the presently claimed invention. Instead, it would provide a composition containing HNT0 and ammonium nitrate and, perhaps, an amount of metal significantly less than an amount at least substantially stoichiometric relative to the oxidizer, as presently claimed.

As previously discussed, Halliday discloses explosive "water-in-fuel" and "melt-in-fuel" emulsions that may contain ammonium nitrate and silver nitrate. Halliday does not disclose or even suggest the presently claimed invention. Moreover, even if the teachings of Halliday and Poole were combined, the combination would not provide the presently claimed invention. Instead, it would provide a composition containing HNT0 and ammonium nitrate and/or silver nitrate and, perhaps, an amount of metal significantly less than an amount at least substantially stoichiometric relative to the oxidizer, as presently claimed.

Therefore, as Poole, Ferrando, Katzakian, Halliday, and Yabsley, whether taken alone or in combination do not disclose or suggest the presently claimed autoignition composition, the present claims are not obvious. Accordingly, it is respectfully requested that the Examiner withdraw the rejection of claims 1, 13 to 18, and 26 to 32 under 35 U.S.C. §103(a).

Claims 1, 13 to 18, and 26 to 32 were rejected under the judicially created doctrine of obviousness-type double patenting, as being unpatentable over claims 1 to 26 of U.S. Patent No. 5,959,242, and the Terminal Disclaimer filed on February 21, 2003, was not accepted for the reasons set forth on pages 9 and 10 of the present Final Office Action.

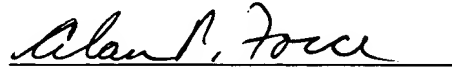
In response Applicant submits that the Terminal Disclaimer filed on February 21, 2003, in compliance with 37 C.F.R. §1.321, was executed by an attorney of record. As evidence, Applicants submit herewith a copy of a Revocation and Power of Attorney filed May 19, 2000, naming Alan P. Force (Reg. No. 39,673) as an attorney of record. Although a Change of Correspondence Address form was filed in this application, the Power of Attorney naming Alan P. Force as an attorney of record was never revoked. Therefore, as the Terminal Disclaimer was executed by an attorney of record, the Terminal Disclaimer overcomes the non-statutory double patenting rejection. Accordingly, it is respectfully requested that the Examiner withdraw the rejection of claims 1, 13 to 18, and 26 to 32 under the judicially created doctrine of obviousness-type double patenting.

Applicants thus submit that the entire application is now in condition for allowance, early notice of which would be appreciated. Moreover, Applicants submit that, as the generic claims are in condition for allowance, all claims that depend from the generic claims, including the claims withdrawn from consideration follow the election of a species for prosecution, are also in condition for allowance. Therefore, Applicants respectfully request that the withdrawn claims, i.e., claims 4 to 12 and 19 to 24, be rejoined. Should the Examiner not agree with the Applicants' position, then a personal or telephonic interview is respectfully requested to discuss any remaining issues and expedite the allowance of this application prior to the issuance of a further Office Action.

No fee is believed to be due for this Response. Should any fee be required, however, please charge such fee to Deposit Account No. 06-1205.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

A handwritten signature in cursive script, reading "Alan P. Force", is written over a horizontal line.

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dissolves more readily than the dried precipitate. Insol in alcohol, or dil acids. *Protect from light.*

USE: In silver plating, in making antiseptic silver preps.

**8653. Silver Chromate(VI).**  $\text{Ag}_2\text{CrO}_4$ ; mol wt 331.73. Ag 65.03%, Cr 15.67%, O 19.29%. Dark brownish-red, cryst powder.  $d_{25} 5.625$ . Soly in water (0°): 0.0014%. Sol in nitric acid and ammonia.

USE: Catalyst for formation of aldol from alcohol; formed at end point of Mohr titration of halides.

**8654. Silver Citrate.** 2-Hydroxy-1,2,3-propanetricarboxylic acid silver salt; Itol.  $\text{C}_6\text{H}_5\text{Ag}_3\text{O}_7$ ; mol wt 512.71. C 14.06%, H 0.98%, Ag 63.12%, O 21.84%.

White, odorless, heavy, crystalline powder; darkens in light. Sol in 3500 parts water, more sol in boiling water; readily sol in dil  $\text{HNO}_3$ , ammonia. *Protect from light.*

USE: Anti-infective dusting powder.

**8655. Silver Cyanide.**  $\text{CAGN}$ ; mol wt 133.89. C 8.97%, Ag 80.57%, N 10.46%.  $\text{AgCN}$ .

White or grayish, odorless powder; stable in dry air; darkens on exposure to light; dec at 320°. *Poisonous!*  $d 3.95$ . Insol in water, alcohol, or dil acids; sol in alkali cyanides and in boiling concd nitric acid; converted by dil HCl into hydrocyanic acid and silver chloride; sparingly sol in dil, more in concd ammonia. *Protect from light.*

USE: For silver plating; formerly used for extemporaneous prep of dil hydrocyanic acid by treatment with HCl.

**8656. Silver Difluoride.** Argentous fluoride.  $\text{AgF}_2$ ; mol wt 145.87. Ag 73.95%, F 26.05%. Prepd by the action of fluorine on silver: Ebert *et al.*, *J. Am. Chem. Soc.* 55, 3056 (1933); by the interaction of fluorine and silver halides: Ruff, Giese, *Z. Anorg. Allgem. Chem.* 219, 143 (1934); v. Wartenberg, *ibid.* 242, 406 (1939); Struve *et al.*, *Ind. Eng. Chem.* 39, 353 (1947). Laboratory procedure according to the equation  $2\text{AgCl} + 2\text{F}_2 \rightarrow 2\text{AgF}_2 + \text{Cl}_2$ ; Priest, Swinehart, *Inorg. Syn.* 3, 176 (1950); Kwasnik in *Handbook of Preparative Inorganic Chemistry*, vol. 1, G. Brauer, Ed. (Academic Press, New York, 2nd ed., 1963) pp 241-242. Prepd from silver chloride and chlorine trifluoride: Rochow, Kukin, *J. Am. Chem. Soc.* 74, 1615 (1952).

White when pure. Usually obtained as a gray-black or brownish, amorphous solid showing a yellow bloom. Sensitive to light.  $d 4.7$ . mp 690°. Very hygroscopic, is converted to a greasy black mass on exposure to atmospheric moisture. Violent reaction with water (instant hydrolytic cleavage). Powerful oxidizing agent giving off some ozone when treated with dil acids. Liberates iodine from iodides. May be stored in quartz or iron ampuls.

Caution: Symptoms due to fluoride. Highly toxic.

USE: In the fluorination of hydrocarbons.

**8657. Silver Fluoride.** Argentous fluoride; silver monofluoride.  $\text{AgF}$ ; mol wt 126.87. Ag 85.02%, F 14.98%. Prepared according to the equation  $\text{Ag}_2\text{CO}_3 + 2\text{HF} \rightarrow 2\text{AgF} + \text{CO}_2 + \text{H}_2\text{O}$ ; also prepd by reduction of  $\text{AgF}_2$  with  $\text{H}_2$ : Ruff, *Die Chemie des Fluors* (Berlin, 1920) p 37; Emeléus in *J. H. Simons' Fluorine Chemistry*, vol. I (Academic Press, New York, 1950) p 32; Kwasnik in *Handbook of Preparative Inorganic Chemistry*, vol. 1, G. Brauer, Ed. (Academic Press, New York, 2nd ed., 1963) pp 240-241.

ξ Flexible leaflets (cubic, NaCl lattice). Very hygroscopic. Darkens on exposure to light.  $d 5.852$ . mp 435°. bp ~1150°. Soly in water when freshly prepd: 182 g/100 ml at 15.5°. In moist air it gradually becomes insol because of basic fluoride formation. Aq solns are neutral and are solvents for silver oxide which renders them alkaline. Also sol in HF,  $\text{NH}_3$ ,  $\text{CH}_3\text{CN}$ . Forms several hydrates. The dihydrate is stable to 39.5° and the tetrahydrate is stable from -14° to +18.7°. In addition, an acid fluoride,  $\text{AgF}_3\text{HF}$  can be prepd by cooling a soln of  $\text{AgF}$  in HF. This loses HF at 0°, forming  $\text{AgF}_2\text{HF}$ .

Caution: Prolonged absorption may cause mottling of teeth, skeletal changes.

USE: To convert organic Br and Cl compds to their fluoro analogs; as antiseptic.

THERAP CAT: Anti-infective.

**8658. Silver Iodate.**  $\text{AgIO}_3$ ; mol wt 282.77. Ag

38.15%, I 44.88%, O 16.97%. White, cryst powder.  $d 5.53$ . mp >200°. Sol in 1875 parts water at 25°, in about 1000 parts of 35% nitric acid, in 2.5 parts of 10% ammonia. *Protect from light.*

USE: As reagent for determining small quantities of chloride, e.g., in blood: Sendroy, *J. Biol. Chem.* 120, 335-445 (1937).

**8659. Silver Iodide.**  $\text{AgI}$ ; mol wt 234.77. Ag 45.95%, I 54.05%. Prepd according to the equation  $\text{AgNO}_3 + \text{KI} \rightarrow \text{AgI} + \text{KNO}_3$ : Kolkmeijer, van Hengel, *Z. Kristallogr.* A88, 317 (1934).

Light yellow, odorless powder; slowly darkened by light. Crystals are hexagonal or cubic.  $d 5.67$ ; mp 552°. Practically insol in water (0.03 mg/l); in acid (except concd HI in which it dissolves readily on heating); in ammonium carbonate. Freely sol in solns of alkali cyanides or iodides; 35 mg dissolve in a liter of 10% ammonia; appreciably sol in concd solns of alkali bromides, chlorides, thiocyanates, thiosulfates, mercuric and silver nitrates. It is slowly attacked by boiling concd acids, but not affected by hot solns of alkali hydroxides.

USE: In cloud precipitation (rain-making).

THERAP CAT: Local anti-infective.

THERAP CAT (VET): In colloidal suspensions as local antiseptic for mucous membranes.

**8660. Silver Lactate.** 2-Hydroxypropanoic acid silver salt.  $\text{C}_3\text{H}_5\text{AgO}_3$ ; mol wt 196.94. C 18.30%, H 2.56%, Ag 54.77%, O 24.37%.  $\text{CH}_3\text{CH}(\text{OH})\text{COOAg}$ .

Monohydrate, white or slightly gray, cryst powder readily affected by light. Sol in about 15 parts water; slightly sol in alcohol. *Protect from light.*

THERAP CAT: Topical anti-infective; astringent.

**8661. Silver Nitrate.**  $\text{AgNO}_3$ ; mol wt 169.87. Ag 63.50%, N 8.25%, O 28.26%. Silver nitrate of commerce is, with the exception of 0.1-0.2% water, practically 100% pure.

Colorless, odorless, transparent, large crystals or white small crystals. *Poisonous!* Not photosensitive when pure; presence of trace amounts of organic material promotes photoreduction. Reduced by  $\text{H}_2\text{S}$  in the dark.  $d 4.35$ . mp 212°, forming a yellowish liq solidifying to a white, cryst mass on cooling. Dec at 440° into metallic silver, nitrogen, oxygen and nitrogen oxides. One gram dissolves in 0.4 ml water, 0.1 ml boiling water, 30 ml alc, 6.5 ml boiling alc, 253 ml acetone; readily sol in ammonia water, slightly in ether. The aq and alc solns are neutral to litmus. pH ~6.

Incompat: Alkalies, antimony salts, arsenites, bromides, carbonates, chlorides, iodides, thiocyanates, ferrous salts, hypophosphites, morphine salts, oils, creosote, phosphates, tannic acid, tartrates, vegetable decoctions, and extracts.

Caution: Caustic and irritating to skin, mucous membranes. Swallowing can cause severe gastroenteritis that may be fatal. See also Silver.

USE: In photography; manuf of mirrors; other silver salts; silver plating; in sympathetic and indelible inks; dyeing hair; coloring porcelain; etching ivory; as a very important and extensively used reagent in analytical chemistry.

THERAP CAT: Topical anti-infective.

THERAP CAT (VET): Astringent, antiseptic, caustic, styptic. In dilute solution as eye lotion. Intramammary to destroy secretory tissue.

**8662. Silver Nitrate, Toughened.** Lunar caustic; fused silver nitrate; molded silver nitrate. Consists of about 97-98% silver nitrate, remainder is silver chloride to toughen it.

White or grayish, hard rods or thin small cones. Darkens on exposure to light. *Protect from light.*

THERAP CAT: Caustic.

THERAP CAT (VET): Locally as escharotic.

**8663. Silver Nitrite.**  $\text{AgNO}_2$ ; mol wt 153.87. Ag 70.10%, N 9.10%, O 20.80%.

Pale yellow, odorless needles; non-hygroscopic; becomes gray in light.  $d 4.45$ . Dec at 140°. Sol in 300 parts water; more sol in boiling water; less sol in aqueous solns of silver nitrate; partly dec on prolonged boiling with water; insol in alcohol; dec by dil acids. *Protect from light.*

USE: For prep of standard  $\text{NaNO}_2$  soln for water analysis; prep of aliphatic nitro-compds; as reagent for primary, secondary, and tertiary alcohols.



**8664. Silver Oxalate.** *Ethanedioic acid silver salt.*  $C_2Ag_2O_4$ ; mol wt 303.76. C 7.91%, Ag 71.02%, O 21.07%.  $AgOOCOOAg$ .

White, cryst powder; at  $140^\circ$  dec violently. d 5.03. Sol in 24,000 parts water; sol in moderately concd nitric acid, in ammonia.

USE: Exptl photographic emulsion (low sensitivity).

**8665. Silver Oxide.** Argentous oxide.  $Ag_2O$ ; mol wt 231.74. Ag 93.10%, O 6.90%. Prepd by making sol silver salt solns alkaline: Madsen, *Z. Anorg. Allgem. Chem.* 79, 197 (1913). Toxicity study: H. F. Smyth et al., *Am. Ind. Hyg. Assoc. J.* 30, 470 (1969).

Brownish-black, heavy, odorless powder.  $d_{25}^{25}$  7.22. Begins to dec at about  $200^\circ$  and at  $250-300^\circ$  decompn is rapid; it also breaks up into its constituents in sunlight. Reduced by hydrogen, carbon monoxide and most metals. Moist silver oxide absorbs carbon dioxide. Sol in 40,000 parts water; freely sol in dil nitric acid, in ammonia; somewhat sol in NaOH solns. Practically insol in alcohol. *Protect from light.*  $LD_{50}$  orally in rats: 2.82 g/kg (Smyth).

USE: As catalyst; in the purification of drinking water; in the glass industry (polishing, coloring glass yellow).

THERAP CAT (VET): Has been used as germicide and parasiticide.

**8666. Silver(II) Oxide.** Argentous oxide; silver peroxide; silver suboxide; Divasil.  $AgO$ ; mol wt 123.87. Ag 87.08%, O 12.92%. Is actually a silver(I)-silver(III) oxide: McMillan, *Chem. Rev.* 62, 65 (1962). Prepd by the oxidation of silver nitrate with potassium peroxydisulfate in an alk medium: Hammer, Kleinberg, *Inorg. Syn.* 4, 12 (1953). Prepn of single crystals: *Chem. & Eng. News* 47, 32 (Aug 11, 1969).

Charcoal-gray powder. *Avoid contact with skin, organic matter, strong ammonia and alkalis.* Malleable. Cubic or orthorhombic system when cryst.  $d_{25}^{25}$  7.483. The dry solid is stable at  $100^\circ$  for 18 hrs, dec above  $100^\circ$  into silver and oxygen. Possesses semiconductor properties and is diamagnetic. *Strong oxidizing agent.*  $K_a$   $7.9 \times 10^{-13}$ . Practically insol in water: 27 mg/l at  $25^\circ$  (decompn). Sol in alkalis and  $NH_4OH$  (with decompn and evolution of  $N_2$ ). In dil acids oxygen is evolved immediately, in concd acid intensely colored solns are formed (brown in nitric acid and olive green in sulfuric acid).

*Caution:* Highly irritating to skin, eyes, mucous membranes, respiratory tract.

USE: In the manuf of silver oxide-zinc alkali batteries.

**8667. Silver Perchlorate.**  $AgClO_4$ ; mol wt 207.32. Ag 52.03%, Cl 17.10%, O 30.87%. Prepn from  $NOClO_4 + AgBr$ : Markowitz et al., *J. Inorg. Nucl. Chem.* 16, 159 (1960).

Deliquescent crystals, dec  $486^\circ$ .  $d_{25}^{25}$  2.806. Freely sol in water: 557 g/100 ml; a satd aq soln contains 84.8% w/w at  $25^\circ$ : Smith, Ring, *J. Am. Chem. Soc.* 59, 1889 (1937). Much less sol in 60% perchloric acid (5.63% w/w). Forms a monohydrate stable to  $43^\circ$ . Sol in many organic solvents, e.g., aniline, pyridine, benzene, toluene, nitromethane, glycerol, nitrobenzene, and chlorobenzene. Solvated crystals have been obtained contg 6 mols aniline, 4 mols pyridine, 1 mol benzene, 1 mol toluene. These compds explode readily when struck: Brinkley, *J. Am. Chem. Soc.* 62, 3524 (1940).

*Caution:* Irritating to skin, mucous membranes.

USE: In the explosives industry.

**8668. Silver Permanganate.** Silver manganate(VII).  $AgMnO_4$ ; mol wt 226.80. Ag 47.56%, Mn 24.22%, O 28.22%. Prepn: Blüsem, Herrmann, *Z. Kristallogr.* A74, 459 (1930).

Violet, cryst powder; dec in light. d 4.49. Soly in water at room temps about 9 g/l. More sol in hot water; dec by alcohol. *Protect from light.*

USE: In gas masks.

**8669. Silver Phosphate.** Silver orthophosphate.  $Ag_3P_4$ ; mol wt 418.58. Ag 77.31%, O 15.29%, P 7.40%.  $Ag_3PO_4$ .

Yellow, odorless powder; darkens in light. d 6.37. mp  $849^\circ$ . Reduced by hydrogen. Soluble in 15,500 parts water, the soly in water is decreased by presence of silver nitrate;

slightly sol in dil acetic acid; freely sol in dil nitric acid, in ammonia, ammonium carbonate, also in alkali cyanides and thiosulfates. *Protect from light.*

USE: In photography for collodion emulsions.

**8670. Silver Picrate.** *2,4,6-Trinitrophenol silver salt; picric acid silver derivative;* silver trinitrophenolate; Picragol; Picrotol.  $C_6H_2AgN_3O_7$ ; mol wt 335.97. C 21.45%, H 0.60%, Ag 32.11%, N 12.51%, O 33.34%.  $(O_2N)_3C_6H_2OAg$ . Monohydrate, yellow crystals. Sol in about 50 parts water; sparingly sol in alc; slightly sol in acetone or glycerol. Insol in chloroform, ether.

THERAP CAT: Antiprotozoal (Trichomonas).

THERAP CAT (VET): Has been used in bovine granular vaginitis.

**8671. Silver Protein.** Argentoproteinum; protargin; silver proteinate; silver nucleate; silver nucleinate. Group of compounds characterized as colloidal combinations of silver and protein. Variably prepd from silver oxide, silver nitrate or other silver salts with gelatin, serum albumin, casein or peptone. Examples of preps: Ger. pat. 105,866 (1897 to Bayer); Brit. pat. 18,478 (1897); H. P. Kaufmann, *Arznei-mittel-Synthese* (Springer, 1953) p 588. Generally classified as mild or strong based on their germicidal and irritant properties. Differentiated by the amount of ionizable silver present: Van Deripe, Konnerth, *Am. J. Pharm.* 111, 65 (1939). Use to stain nerve fibers: D. Bodian, *Anat. Rec.* 65, 89 (1936). Neuronal selectivity and use in light and electron microscopy: I. S. Zagon, J. H. Haring, *Acta Anat.* 114, 193 (1982); in Alzheimer's disease: C. Duyckaerts et al., *Acta Neuropathol.* 73, 167 (1987).

*Mild silver protein, argentum vitellinum, Argylol, Silvol.* Brown, dark-brown, or almost black, odorless, lustrous scales or granules. Contains ~20% silver. Somewhat hygroscopic. Freely sol in water. Almost insol in alcohol, chloroform, ether. *Keep well closed and protected from light.*

*Strong silver protein, albumose silver, Protargol.* Pale yellowish-orange to brownish-black, odorless powder. Contains ~8% silver, most of which is present in ionic form. Somewhat hygroscopic. Freely sol in water. Almost insol in alcohol, ether, chloroform. *Keep well closed and protected from light.*

USE: Neuronal-selective histological stain; general contrast medium for electron microscopy.

THERAP CAT: Antiseptic.

THERAP CAT (VET): Antiseptic.

**8672. Silver Selenate.**  $Ag_2O_4Se$ ; mol wt 358.69. Ag 60.14%, O 17.84%, Se 22.01%.  $Ag_2SeO_4$ . Prepd by treating silver carbonate with selenic acid: Mitscherlich, Pogg. *Ann.* 9, 623 (1827); *Ann. Chim. Phys.* [2] 36, 100 (1827). Orthorhombic crystals. d 5.72. Solubility in water ( $20^\circ$ ): 1.182 g/l.

**8673. Silver Selenide.**  $Ag_2Se$ ; mol wt 294.70. Ag 73.21%, Se 26.79%. Occurs in nature as the mineral naumannite. Prepd by melting silver and selenium together and by passing hydrogen selenide into a soln of silver nitrate: Berzelius, cited by Mellor, *A Comprehensive Treatise on Inorganic and Theoretical Chemistry* 10, 771 (1930); by combination of ions or elements in solns or melts: Kulifay, U.S. pat. 3,026,175 (1962 to Monsanto).

Gray, hexagonal, microscopic needles. mp  $880^\circ$ .  $d_{25}^{25}$  8.216. Two forms exist; transition temp at  $133^\circ$ . Forms metallic silver and selenium oxide when heated in oxygen; transformed by chlorine into silver and selenium chlorides; oxidized to silver selenite by fuming nitric acid. Sol in molten silver or bismuth without chemical change. Practically insol in water.

**8674. Silver Selenite.**  $Ag_2O_3Se$ ; mol wt 342.69. Ag 62.95%, O 14.01%, Se 23.04%.  $Ag_2SeO_3$ . Prepd by dissolving silver selenide in boiling nitric acid and cooling: Berzelius, cited by Mellor, *A Comprehensive Treatise on Inorganic and Theoretical Chemistry* 10, 824 (1930); from a soln of silver carbonate in selenious acid: Thomsen, *Ber.* 2, 598 (1869).

Needles. d 5.9297. Stable to mp  $530^\circ$ ; dec above this temp to silver, selenium oxide and oxygen. Sparingly sol in cold water; freely in hot water; sol in nitric acid.